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GRAPES.

By
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AND
C. F. AUSTIN.

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GRAPES.

GENERAL CONSIDERATIONS.

BY F. S. EARLE.

SOILS AND PLANTING.

Grapes can be grown with considerable success in all parts of Alabama. Certain portions of the State seem to be particularly well adapted to them, being comparatively free from rot and mildew and producing a grape of fine flavor and appearance, and of exceptionally good shipping quality. This is a point of prime importance, since in this latitude grapes ripen in midsummer, when the weather is hot and frequently showery, conditions that make all fruits difficult to handle.

The best grape lands in the State are probably to be found in the high lying granitic region of Eastern Alabama. This extends from a little above Columbus, Ga., to within about seventy miles of the northern border and westward to a little beyond the Louisville & Nashville Rail Road in Chilton county. Almost equally good locations may be found among the high table lands of the coal measures lying to the north and west of the granitic region. In South Alabama the best grape lands are the red soils of the LaFayette drift which cover considerable areas extending as far south as Mobile county.

Grapes will grow freely on any of the sandier lands in South Alabama, but the vines are often short lived on account of the root rot (See p. 67), and the fruit does not ship well, being subject to the ripe rot. This

causes the berries to mould in transit and also by attacking the stems and rendering them stiff and brittle causes the berries even when sound to "shell" or drop off the stems badly, thus presenting an unattractive appearance in market. These two enemies will be more troublesome in Southern Alabama, even on the red lands, than in the northern part of the State. And the number of varieties that will succeed even fairly well is much smaller. Such well known market kinds as Moore's Early, Worden and Catawba should not be planted in South Alabama, while in the central and northern portions almost any of the kinds usually found in the Eastern States will do at least fairly well.

Grapes can be successfully grown on land that is too steep, rocky and broken to admit of cultivation in ordinary field crops. It is doubtful, however, if such locations have any advantage for this crop over similar lands that lie sufficiently level to admit of easy and cheap cultivation, though such claims are often made. The greater expense attending the planting and caring for a vineyard on such lands makes their utilization for this purpose of doubtful expediency under present agricultural conditions.

No special preparation of the soil is necessary for planting grapes further than a good deep plowing and thorough harrowing. Rows should be run about ten feet apart. Unless the land is nearly level the rows should be carefully run on grade lines so that in cultivating the land each row will act as a terrace. These crooked rows circling the hill sides are unsightly and are somewhat troublesome in cultivating and trellace building, but it is the only way to prevent the wasteful washing of the land. On our light soils permanent rows running up and down the hills are certain to result in disastrous gullying and wasting of the soil.

Most of our grape lands are so thin as to require a small amount of fertilizer annually to produce the best results. This should be scattered along a furrow run on each side of the row in early Spring so that it will be covered by the first cultivation, or after the first season it may be broadcasted and cultivated in for the roots of the vines will occupy all parts of the land. For the first season it is best to use the side furrows, or still better, the fertilizer may be scattered along a deep central furrow run in advance of planting. The fertilizer requirements of our best grape lands are fairly uniform for all parts of the State and the following formulas will be found quite satisfactory: Either bone meal 4 parts and kainit 1 part, or if cheaper acid phosphate, 3 parts, cotton seed meal 1 part and kainit 1 part. About one pound of either of these mixtures per vine will be sufficient for the first three years. After the vineyard comes into heavy bearing a larger quantity will usually be profitable. The exact amount to use must be determined by the condition of the vines. They should be able to carry and ripen a full crop of fruit and at the same time make a free, but not extravagat growth of wood.

The distance between the vines in the row will depend to some extent on the variety. Short jointed, slow growing kinds like Delaware may be planted as close as 6 feet but Concord and similar free growing kind should have as much as 8 to 10 feet, while very rampant growers should be given even more room.

Grapes are usually propagated from cuttings and it is quite possible to grow a vineyard by simply sticking down one or more cuttings at the place where each vine is to stand permanently. Usually a better stand and more satisfactory results can be secured by planting nursery grown one year old vines. Some planters ad-

vocate using two year old vines, but usually fully as good results can be had with the one year old vines and the cost is considerably less. The vines should be planted about an inch deeper than they stood in the nursery row, and the dirt should be tramped firmly about the roots, then cut off the top leaving only one good bud above ground. This last is quite important for if too many shoots start the growth of all will be feeble.

Here at the South where there is little or no danger of heaving from the deep freezing of the soil planting may begin at any time after the leaves fall in autumn and can be continued whenever the ground is in fit condition throughout the winter. For best results all tree and vine planting in this latitude should be finished by the first of March. True later plantings are sometimes successful. At some of the colony towns in North Alabama, owing to delay in preparing the land, vines have been held in cold storage until May and have then been planted with fairly satisfactory results, but it is doubtful if such late planting is ever really advisable. It should be remembered that root growth normally begins much earlier than leaf growth and if vines are planted so late that the weather is warm enough to force the immediate unfolding of the leaves it is done at the expense of the reserve vitality of the vine since there is no sufficient root development to support them and if dry, hot weather sets in the result will almost certainly be the death or permanent injury of the vine.

TRAINING AND PRUNING.

After the vines begin to grow the first spring they should be gone over regularly once a week or once in ten days in order to remove any surplus shoots and to pinch out the young lateral branches that will be found form-

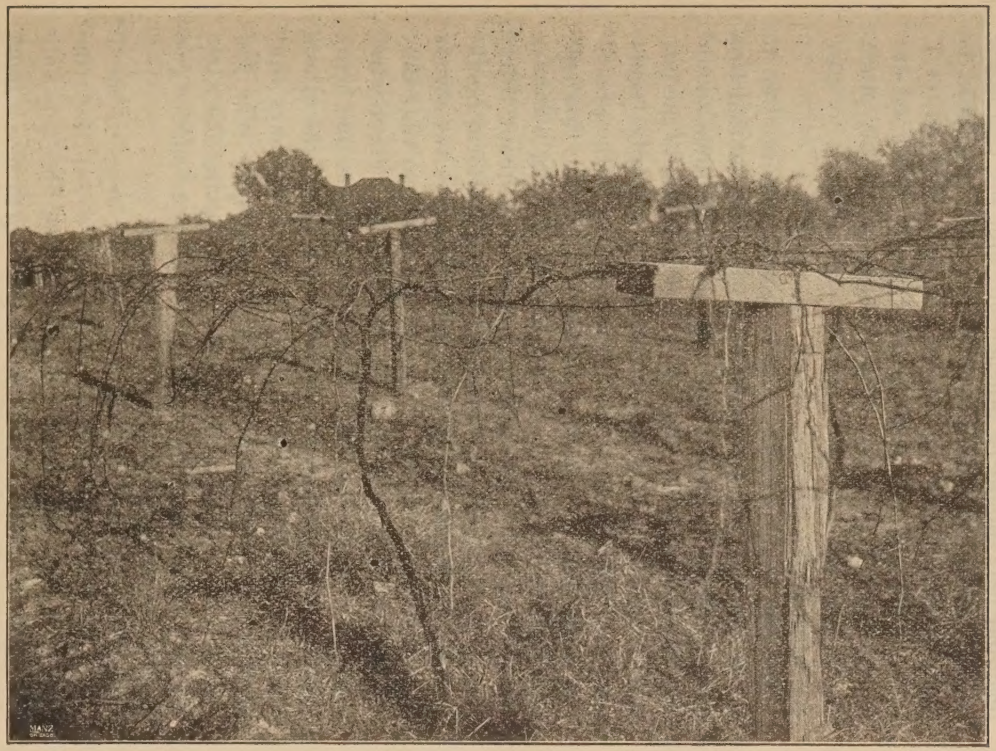

FIG. 1, 3 YR. OLD DELAWARE VINE ON HORIZONTAL TRELLACE, UNPRUNED.

ing in the axil of each of the older leaves. It is very desirable to confine the growth to a single unbranched cane until this reaches a length of about four feet. Then the terminal bud should be pinched out and the two upper latteral branches which will soon appear should be saved thus bringing the vine to the form of the letter T. After this form has been secured, which with good cultivation should be by the first of July, the weekly pinching can be discontinued and the vine allowed to grow and branch at will.

During this first summer the vine may be allowed to sprawl on the ground or if preferred it can be tied to a light temporary stake. The permanent trellace should be built the following winter. For this latitude the horizontal or modified Munson trellace is strongly recommended. The method of training outlined in the preceding paragraph should be followed only where this trellace is to be adopted. It is made by setting ordinary fence posts along the row at intervals of about thirty feet. The tops are now sawed off at a uniform height of about four and a half feet, and cross bars twenty-six inches long are spiked on top of the posts so that they stand at right angles to the line of the row. Three wires are now stretched on top of these cross bars, one being stapled at the middle directly over the posts, the others about an inch from either end of the cross bars thus leaving the wires about twelve inches apart. The end posts should be braced as in fence building and the wires brought down and made fast to a "dead-man" buried two or three feet from the bottom of the post.

The vines are now lifted and the two arms of the T are tied to the middle wire. This first season the arms should be cut back to about a foot each and any side branches should be cut away. In pruning grapes it must

be born in mind that every well developed bud on canes of the previous summer's growth will develop a fruiting shoot bearing on an average three clusters of grapes. This close pruning is therefore necessary to prevent overbearing, since not only the arms but the main stem also are in this case of the last seasons growth and hence fruit bearing. Even this close pruning would still allow overbearing if all the buds on the main stem were allowed to grow. All the lower ones should be rubbed off when they start in the spring, thus confining the growth to the buds on the arms and a few at the top of the stem. These shoots will grow rapidly and will for the most part fall over the side wires and be supported by them while their coiling tendrils will clutch the wires so firmly as to obviate the necessity for much summer tying. This is a great saving of labor over the vertical trellace system where each new shoot has to be tied one or more times during the summer. Its principal advantage lies however, in the fact that the leaves form a dense canopy sheltering the clusters of fruit which hang below from the sun and from rain and dew, yet leaving them freely exposed to the circulation of the air. This serves to a considerable extent to protect the fruit from fungus attacks, particularly from the "ripe rot" that is such a serious drawback, especially in the southern part of the State.

By this system no summer pruning or training is necessary except to rub off any shoots that start on the lower part of the stem and the tying up of such shoots as fail to support themselves on the side wires. The subsequent winter pruning is also very simple. The old stem is retained but the old arms are cut away saving only one good new shoot from near the base of each, which is bent down and tied to the middle wire as before thus again bringing the vine to the form of the letter T.

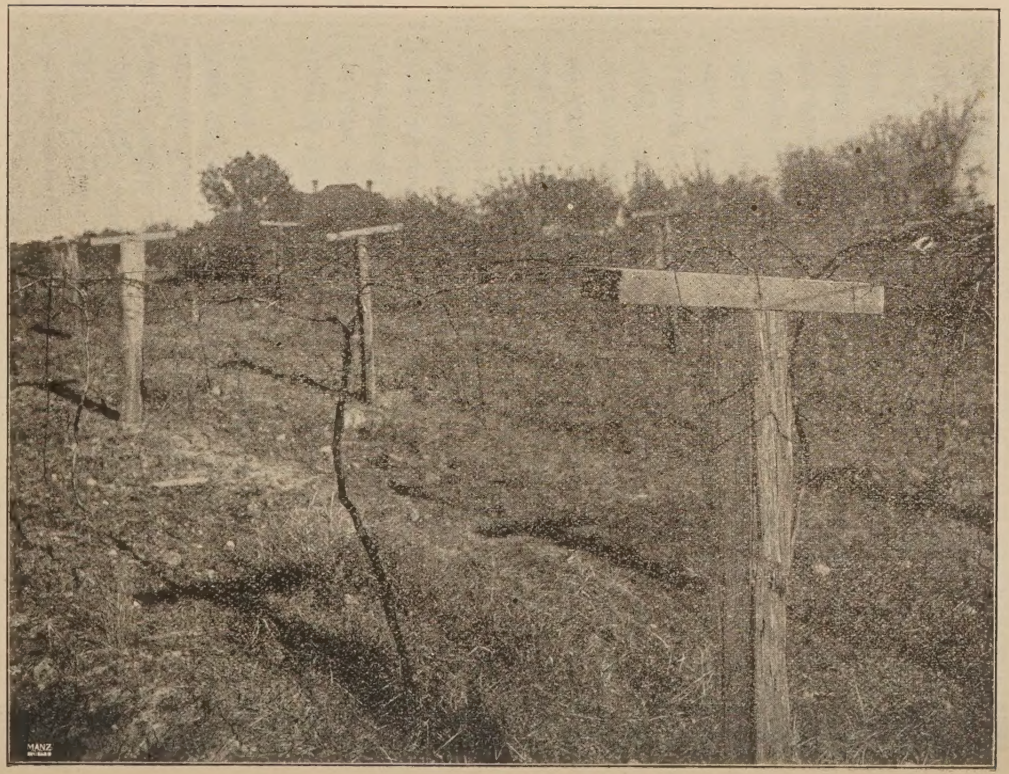

FIG 2. THE SAME VINE AS IN FIG. I, AFTER WINTER PRUNING.

Now, however, those arms must be left longer than before since the stem is no longer of young bearing wood and since the greater age of the vine will enable it to bear a larger crop. Where the vineyard is well cared for and the vines are in full vigor the arms may be left of such length that the end of one just meets the end of the one from the next vine thus providing a continuous line of bearing wood from one end of the row to the other. However, where vines are weak from any cause the arms should be cut proportionately shorter. The accompanying cuts are from photographs of a three year old Delaware vine that has been grown according to this system, one taken before and the other after the annual winter pruning.

This winter pruning can be done at any time after the leaves fall in autumn till about the middle of February. Later than this the vines become full of sap and they will bleed badly if cut.

CULTIVATION.

The vineyard should be cultivated sufficiently often to keep a surface dust mulch to hold moisture and also to prevent the growth of weeds. The cultivation should always be shallow since on most soils vines do not root deeply and deep plowing will break many roots, thus doing more harm than good. It may be necessary to use a one horse turning plow for the first working in the spring but for the later workings a five toothed cultivator is the best implement. The Planet Junior with attachments for regulating the depth is a useful form of this tool for vineyard purposes. Two or three hoeings or more will be necessary to remove grass and weeds from the row where they cannot be reached by the cultivator.

In most cases it will probably be well to discontinue cultivating the last of July and plant the middles to some of the bush field peas like the whipporwill. The running kinds are likely to make trouble by climbing on the vines and trellaces. The peas will make a useful mulch for the ground during the winter and will enrich the soil by supplying nitrogen so that all cotton seed meal may be omitted from the fertilizer. A still better winter protection to the soil is afforded by sowing to oats or rye in September. This of course must be plowed down early in the spring for if allowed to mature it would greatly injure the grapes. It requires some extra work in the spring to subdue a grain crop and it adds no nitrogen to the soil as do the peas but only serves to furnish a winter cover that prevents leaching and washing of the soil.

SPRAYING FOR INSECT AND DISEASES.

It is not intended in this place to give a detailed account of the different fungous and insect enemies of the grape. They are quite numerous and have been studied perhaps more than those of any other cultivated plant, so that there is an enormous literature treating of grape diseases. For practical purposes it is sufficient to know that the combined treatment with Bordeaux mixture and Paris green will serve to prevent serious injury from the greater part of those that are likely to be troublesome in this State. In fact, in most seasons, good crops can be grown in our best grape regions without treatment of any kind. In wet seasons like the present, however, unsprayed vineyards are liable to considerable injury from rot and mildew even in the most favored locations, so it will probably in the long run, always pay to give vineyards the following treatment.

First in early spring before the buds swell spray very thoroughly with Bordeaux mixture going up and down both sides of the row and so directing the spray that every part of the vine is coated with the bluish liquid. Printed directions for making Bordeaux mixture vary considerably but the following will be found convenient and effective. Put 6 pounds of bluestone (copper sulphate) in a loosely woven gunny sack (often called croker sack in Alabama) and suspend it just under the surface in a barrel half filled with water. In this way the bluestone will be dissolved in half an hour while if thrown in the bottom of the barrel it will take it all day. In another barrel slack 4 to 6 pounds of good lime and pour in enough water to make half a barrel of thin whitewash. Four pounds of lime, if fresh and unslaked, will be sufficient to combine with and neutralize the bluestone but the full six pounds does no harm and if to be applied when the vines are in leaf will be a little safer as regards burning the foilage. When the bluestone is all dissolved pour the whitewash slowly into the bluestone barrel with constant stirring. Let it stand two or three minutes to allow any heavy particles of lime to settle and the mixture is ready for use. A better mixture and one that stays longer in suspension is made by thus combining the dilute solutions than by combining while concentrated and then diluting. If the mixture stands for some time before using it will be necessary to stir it up thoroughly and then allow it to settle a few minutes before dipping it out of the barrel. If possible it should be used the day it is made as it deteriorates on long standing. For spraying vineyards some form of knapsack sprayer is often used but in large vineyards this is laborious and it is better to use a barrel pump mounting the barrel on a narrow sled that can be drawn along between the rows by one horse. If the

pump is provided with two lines of discharge hose the sides of both rows can be covered by one trip through each middle and the work will be done about as fast as a horse will naturally walk. This requires three men, two to direct the spray nozzles and one to drive and pump.

A solution of the blustone, 2 pounds to the barrel without the lime is sometimes advised for this first spraying. It is perhaps a little more penetrating than the Bordeaux mixture but it is washed off by the first rain.

The great advantage of Bordeax mixture over other fungicides is that it adheres to the plant and withstands washing rains for so long a time.

If the vines have been previously diseased or if the locality is one where much trouble from black rot is to be expected the vines should be sprayed again when the shoots first start and the young leaves are the size of the thumb nail. In any case another spraying should be given after the flower buds are well formed but just before the flowers open. At this time ¼ pound of Paris green should be rubbed to a paste with a little water and mixed with each barrel of the Bordeax mixture. The next spraying should be given as soon as the flowers fall and the young grapes can be detected, and another and final spraying should follow in about ten days or two weeks, when the berries are the size of peas. Paris green should be used at both these later sprayings. After this time Bordeaux mixture should not be used till after the fruit is gathered as it is likely to presist on the clusters and disfigure them. If the season is wet another spraying will be advisable as soon as the fruit is picked in order to protect the foliage and hold it on the vines through the fall to properly ripen the wood for the next crop.

Where this treatment is faithfully carried out very little trouble will be had from the black rot or from any

of the leaf destroying fungi or insects. Even the leaf roller will be largely held in check since the leaf surface will be covered with the poisoned spray before he draws it together with his protecting web. Any of these that escape should be picked off by hand and destroyed since they become very troublesome if allowed to multiply unchecked.

OTHER DISEASES.

The ripe rot (*Glocosporium fructegucnum*) that has been mentioned as being especially injurious in South Alabama will not be fully controlled by this treatment. Much can be done to avert this trouble by using the horizontal trellace (see p. 59), which furnishes a root of foliage to protect the fruit from the rain and dew and from the direct rays of the sun. It is probable that spraying just as the fruit is coloring with eau celeste, liver of sulphur or some other fungicide that could be used without staining the fruit would be useful in preventing loss from this disease, but no sufficiently accurate experiments in this line have been conducted.

Another serious trouble that will not be reached by spraying is the root rot. This disease was mentioned in Bull. 69, p. 272, where it was stated to be the same as the "Pourridie" of the French, which is caused by the growth of the fungus *Dematophora necatrix* on the roots. This is now believed to have been an error. Repeated attempts have been made to isolate and cultivate the organism causing the whitish discoloration under the outer bark of diseased roots, but so far without success. No fungus like the *Dematophora* has in any case developed and further observation on the behavior of this disease in the field shows that it works much more slowly than the European root rot, called "Pourridie," which usually kills infested vines in from one to two years.

The presence of this disease in the vineyard is usually first made manifest by the sudden browning of the margin of the leaves on certain vines in mid-summer, usually two or three weeks before the ripening of the fruit. This attack may be followed by the immediate death of the vine, leaving the fruit to dry and shrivel in the sun or the crop may mature and the vine linger along till fall, being found entirely dead at the winter pruning. In other cases only a part of the top will die, some branches putting out a feeble growth for two or three seasons longer. If an examination is made at the root of one of these vines a whitish mould-like coating will be found between the green inner bark and the shaggy outer-coating and the inner bark will be more or less browned and killed. This white coating can usually be traced several inches above the ground and down on to all of the larger roots. In severe cases the smaller fibrous roots will be rotted away, but they do not seem to be the original seat of the trouble, for in some cases the crown and large roots will be affected, while the smaller ones are mostly still healthy. This whitening of the inner bark is not confined to vines in which the foliage has given signs of the disease, but may frequently be found on vines that are still making a strong growth and on which the foliage is perfectly healthy. The failure of the leaves seems to come suddenly when the disease has progressed sufficiently far to cut off wholly or in part the water supply from the roots. The whitening can also often be found on old scuppernongs and on wild grapes in the woods, though these are seldom or never killed by it. Its presence on the roots of cultivated vines is by no means a sure sign of immediate death. A row of 38 Concord and Ives vines was examined in January, 1896, in which every vine showed its presence to a greater or less extent, and yet at this writing (November, 1900), 14 of those

vines are still alive and at least half of these are quite vigorous. In January, 1898, in planting a lot of Delaware vines, this whitening of the roots was observed on some of the vines when received from the nursery. About forty of these were sorted out and were planted by themselves. These are now all alive but one, and seem as vigorous as their neighbors, but as will be shown below the Delaware is very resistant to this disease.

The following statistics of grape planting at the Station will show that the disease is a very serious one. From the early bulletins we learn that the two first vineyards planted nearly all died, presumably from this cause, and they had been rooted up before my connection with the Station (January, 1896). Delaware, Ives, Concord and Perkins had been found to live longer than the other kinds planted, and a third vineyard containing 338 vines of these four kinds was planted in 1886. In 1894 vacancies were replanted and another vineyard of 313 vines was planted. This contained a number of other kinds. The number alive in 1896 was 584. An examination showed only 83 vines in both lots that were free from this whitening of the bark. The following table shows the condition of the different varieties at the present time:

Kinds.	No. of vines planted 1886 to 1894.	No. alive Nov., 1900.	
Concord	68	12	17.6%
Ives	147	40	27.2%
Perkins	114	12	10.5%
Delaware	111	82	73.8%
Herbemont	5	5	100. %
Rulander	10	10	100. %
Niagara	15	2	
Wyoming Red	2	1	
Diana	11	1	
Brighton	4	0	
Lindley	14	1	
Wilder	11	0	
Humboldt	10	1	
Moore's Diamond	14	1	
Elvira	10	0	
Worden	6	0	
Total now alive		168	

Other kinds of which there were only two or three vines each are all dead. There is no proof that all these vines died from root rot, but certainly the great majority of them did die from this cause, and the loss of 483 vines in six years out of the 651 alive or planted in 1894 or a little over 75% is certainly a serious matter.

The most important thing to be noted in the above table are the complete exemption of Herbemont and Rulander from the disease and the comparative immunity of the Delaware. Ives alone of the pure *labrusca* varieties shows any power of resistance. The *labrusca* X *vinifera* hybrids also all seem very susceptible. It is a point of much importance to the future of Southern grape growing to learn which of the races and varieties of grapes now in cultivation are resistant to this disease.

In 1896 an experiment was planned to see if different methods of fertilizing or other soil treatment would have any effect in controlling this disease. Plots of two rows each were treated with different fertilizer formulas, including among other things heavy applications of kainit, lime, coal ashes and stable manure. This treatment was continued for three years, but with no marked result so far as the disease was concerned. At this writing the rows receiving a heavy mulch of coal ashes are in slightly the best general condition. The heavy applications of kainit, two to six pounds per vine in the different years, had an injurious effect on the fruit (Delaware), making it paler and causing somewhat uneven ripening. Stable manure was applied at the rate of a one horse wagon load to fifteen vines. This was considered excessive, but contrary to expectation no bad results followed and these rows have yielded more heavily than any others in the vineyard. The variety in this test was also Delaware.

This disease in a general way is worse in South than in North Alabama, and it is worse on sandy lands than on clays. Some black sandy soils in Southeast Alabama seem to be particularly subject to it, vines there usually dying after bearing one or two crops.

At present we can only say that the cause of the disease is entirely unknown and that the remedies so far tried have proved utterly ineffective. The fact, however, that the Herbemont and Rulander vines in the old vineyard have proved perfectly resistant, standing unharmed while other kinds died on all sides of them suggests a remedy that seems to offer a simple and practical solution for the difficulty. In soils subject to root rot why not graft susceptible kinds like Niagara on resistant roots as is being done with the *vinifera* varieties in France and California to resist the Phylloxera. It is probable that other varieties of the *Bourquiniana* and

rupestris races to which the Herbemont and Rulander respectively belong will prove equally resistant, and experiments are planned to determine what varieties will make the best stocks for our leading market kinds using for the purpose the infected land now occupied by the old vineyard.

VARIETIES.

The varieties of grapes usually grown in this country for table use are descended from one of the following five species or they are hybreds produced by making crosses between them. These parents species are *Vitis Labrusca,* the Northeastern Fox grape; *Vitis vinifera,* the European grape, probably of Asiatic origin; *Vitis Bourquiniana,* a race of Southern grapes of which Herbemont is best known, probably of European origin; *Vitis Lincicumii,* the Texas Post Oak grape; and *Vitis rotundifolia,* the Muscadine or Bullace. The varieties descended from each of these kinds though differing widely among themselves, all have certain traits or characteristics in common, hence we often speak of them collectively as the Labruscas, the viniferas, the rotundifolias, etc.

For wine making descendants of other species as *vitis rupestris, V. vulpina and V. æstivalis* are also grown..

The most widely grown market grapes of the Eastern States belong to the *Labrusca* type. This includes such well known kinds as Concord, Ives, Perkins, Catawba and Niagara. As a rule they are resistant to the mildews and to phylloxera or root louse, but they are subject to black rot and as shown above they suffer seriously from root rot. We must, however, still depend largely on them for market grapes.

The *vinifera* grapes are largely grown in California

and include such well known kinds as Muscat of Alexandria, Flame Tokay and Black Hamburg. Pure bred *viniferas* can not be grown in this State on account of their susceptibility to mildew and phylloxera. They are also subject to root rot and they start so early in the spring as to be often injured by late frosts. Some of the *Labrusca x vinifera* hybreds are fairly successful and include our highest flavored kinds, such as Brighton, Jefferson, Lindley and Wilder.

The *Bourquiniana* grapes include a few southern kinds, of which Herbemont is best known. They are fully resistant to root rot though somewhat subject to mildew and black rot. They are valuable wine grapes for the South, but most of them can hardly be considered among the market table kinds. The group is of importance and is introduced here principally because the Delaware is now supposed to belong here or at least to be a hybred between this species and *V. labrusca*. Its great resistance to root rot would seem to strengthen this view and from our present experience it must be considered the one best variety for general planting in this State. It is, however, a rather feeble grower and it requires heavy fertilizing, good cultivation and close pruning or it will not be satisfactory.

The varieties descended from *Vitis Linecumii* or the Post Oak grapes are all new-comers but some of them like America, Carmen and Fern Munson are very promising and are worthy of a careful trial. In the able hands of Mr. T. V. Munson, of Denison, Tex., the descendants of this species are developing a remarkable number of valuable kinds well adapted to the South, some of which seem destined to supplant the kinds now generally cultivated in this region. They are resistant to mildew and black rot and probably also to root rot,

but on this point we cannot yet speak with certainty. All interested in Southern grape growing should send to the Texas Experiment Station at College Station, Tex., for Bull. 56, in which Mr. Munson gives the history of his work in producing new varieties of grapes.

Vitis votundifolia includes the scuppernong and the wild muscadines. It belongs to a different division of the genus from the species discussed above, all of which are spoken of by the distinctive name of bunch grapes at the South. The rotundifolias are southern grapes, not being hardy at the North. They seem to be free from diseases of all kinds and are very easily cultivated, their only requirement being an arbor to climb on and keep them off the ground. No pruning is required except to pinch off side shoots during the first year. They are not suited to distant shipment but are very useful for the home market and for wine. The Scuppernong is the only kind that is really in general cultivation, but some of the black kinds like Thomas, Memory, Mish and Flowers are also desirable and should be more generally planted. Memory has proved decidedly more hardy to cold than any of the other kinds. (See Bull. 106, p. 170.)

A new vineyard of 100 varieties was planted at the station in January, 1898. It bore its first crop this season. Careful notes were taken on the different varieties by Mr. Austin and his report on them forms a part of this Bulletin. Some of the newer kinds seem very promising but we are as yet hardly justified in recommending them for general vineyard planting.

Rockwood deserves especial mention as the best of the very early black grapes. It resembled a small Concord but ripens with Champion.

Among the old well known kinds the following list includes the best for market purposes: Black; Concord,

Ives. Red; Delaware, Brighton. White; Moore's Diamond, Niagara.

MARKETING.

Southern grown grapes are more perishable than the same kinds grown at the North, because they ripen during the heat of mid-summer. For this reason marketing must be expedited in all possible ways. Only a few hours can be allowed for wilting. Those picked in the morning should be packed in the afternoon and those picked in the afternoon packed early the following morning, and when packed they should be rushed into refrigerator cars as rapidly as possible. Prices for southern grapes are too low at present to justify express shipments and the business can only be permanently successful at those points where enough are grown to load refrigerator cars.

Grapes are best gathered in flat wooden trays or boxes. Twenty by thirty inches by six inches deep is a convenient size. The bunches are cut from the vines with clippers made for the purpose or with a sharp knife and are placed carefully two layers deep in these boxes. When full they may be hauled to the packing house on a spring wagon. The two layers of clusters will not fill them quite full so they may be safely piled one on top of another in hauling. At the packing house they should be stacked up in an open well ventilated space and should be crossed in piling so that the ends of each box are freely exposed to the air. In a few hours the stems will have wilted a little so that they will settle together limply. They are now ready for packing. The climax basket is more used than any other package for grapes and everything considered it is probably the best. It is an oblong basket with a board bottom, solid veneer sides, a solid veneer cover and a wooden hoop handle.

The usual sizes hold about 5 and 8 pounds. In packing it is placed in front of the packer endwise with the farther end elevated on a four-inch block. The clusters are carefully examined and all defective berries removed with sharp pointed clippers. All inferior or seriously defective bunches should be thrown out for the vinegar barrel or the wine press. The basket is filled beginning at the lower end in such a way that as smooth and compact a surface as possible is built up from the tips of the bunches, all stems being covered by the succeeding bunches. It is impossible to do this so nicely when the basket stands flat and is filled from the bottom upward. When full the grapes should stand from half to three-quarters of an inch above the top of the basket as they will give down without injury by carefully pressing the cover and if an occasional berry is mashed it is better than to have the basket seem slack filled when opened.

Quart strawberry baskets and crates and the six basket Georgia peach crate are both sometimes used for grapes and answer fairly well.

For methods of handling refrigerator cars and for a general discussion on methods of marketing perishable fruits and vegetables see Bull. 79, pp. 103-110.

NOTES ON THE VARIETIES OF GRAPES FRUITING IN THE STATION VINEYARD DURING 1900.

BY C. F. AUSTIN.

In discussing the varieties of grapes grown on the station grounds, we have given a few of the main points about each variety, and a note as to its value for planting. On further trial some of the varieties may give better results than is here indicated.

Under most of the varieties the name of the race or parent species is given. When the varieties are of hybred origin the names of both, or all of the parent species are given connected by the X mark.

It should be stated that the only ground available for this variety vineyard was an old washed and gullied hillside where the soil conditions are far from uniform. This is unfortunate as some of the varieties have had a much poorer chance than others.

The season was late this year so that the dates of ripening given below are about a week later than in average seasons at this place.

AGAWAM, (Rodgers No. 15.) *Labrusca X vinifera.*—Vines strong and vigorous; clusters large, long, shouldered, only moderately compact; berries large, nearly round, reddish brown, skin thick; pulp tender, juicy, sweet, very pleasant; season first of August; fairly productive. A fine grape for home use.

AMERICA, *Lincecumii X rupestris.*—Vines very vigorous. Clusters large, well shouldered, compact; berries small, round, black, with blue bloom; pulp firm, acid, quality fair; season last of July. A very productive grape, and promises a fair market sort.

AMINIA, *Labrusca X vinifera.*—Vines small, weak. Clusters small; berries medium in size, black, with blue bloom; pulp tender, juicy, quality poor; season last of July. A grape of no value here.

AUGUST GIANT, *Labrusca X vinifera.*—Vines small. No fruit, worthless here.

BACCHUS, *Labrusca X vulpina.*—Vines fairly vigorous. Clusters small, compact; berries very small, round, black, with blue bloom; pulp quite firm, quality poor; season last of July; not productive; a grape of no value here.

BARRY. (Rodgers' No. 43), *Labrusca X vinifera.*

—Vines small and lacking in vigor. Clusters short, broad, compact, shouldered; berries very large, round, black, with thin blue bloom; pulp tender, juicy, quality fair; season middle of August; fairly productive. It is not a very promising grape.

BEACON, *Labrusca X Lincecumii.*—Vines strong and vigorous. Clusters large, long, compact; berries very large, round, acid, quality fair; season first of August; very productive. It is a fair market grape.

BELL, *Labrusca X Bourquiniana.*—Vines quite vigorous. Cluster small, compact; berries small, round, greenish white; pulp tender, juicy, quality very poor; season last of July; not productive. A grape that is worthless here.

BETRAND.—Vines strong. Clusters very large, long, moderately compact; berries very small, round, black, with blue bloom, skin thick; pulp tender, juicy, slightly acid; season last of August; very productive. It gives indications of little value other than for wine.

BIG EXTRA, *Lincecumii X Labrusca X vinifera.*—Vines large and very strong. Clusters large, long, compact; berries large, round, black with blue bloom, skin thick; pulp firm, acid, quality fair; season last of July. It is not productive enough for a market grape.

BIG HOPE, *Lincecumii X Labrusca X vinifera.*—Vines very vigerous. Clusters large, long, moderately compact; berries large, round, very dark red; pulp tender, juicy, quality fair; season middle of August; very productive. A promising market grape.

BRIGHTON. *Labrusca X vinifera.*—Vines small and only fairly vigorous. Clusters medium in size, compact, shouldered; berries medium, round, dark red when fully ripe, skin thin; pulp tender, juicy, rich, sweet, quality extra good; season last of July; fairly produc-

tive. An excellent grape for home use here. To insure perfect pollenation, it must be planted next to other varieties.

BRILLIANT, *Bourquiniana X Labrusca X vinifera.*—Vines small, fairly vigorous. Clusters medium in size, moderately compact, shouldered; berries medium, red, skin thin; pulp tender, juicy, sweet, quality very good; season last of July; productive. A very fine grape for table use.

CAMPBELL'S EARLY—Vines strong, vigorous. Clusters large, long, loose; berries very large, globular; black, with thin blue bloom; pulp tender, juicy, very pleasant, quality good; season last of July; fairly productive. A very promising grape for home use.

CARMEN, *Lincecumii X Labrusca X vinifera.*—Vines vigorous. Clusters usually very large, and compact; berries large, round, black, with blue bloom; pulp firm, quality fair; season first of August; very productive; a fair market grape.

CATAWBA, *Labrusca*—Vines small, but rather thrifty. Clusters small, compact, but withered before ripening. This grand grape is out of its place here.

CENTENNIAL.—Vines very strong growers. Clusters large, long, moderately compact; berries large, oval, black, skin thick; pulp tender, juicy, soft, quality fair; season last of July; very productive. A fair market grape.

CHAMPION, *Labrusca.*—Vines fairly vigorous. Clusters medium in size, very compact, well shouldered; berries medium, round, black; pulp tender, juicy, quality very poor; season middle of July; very productive. Its principal value as a market grape lies in its extreme earliness and productiveness.

CLINTON, *vulpina X Labrusca.*—Vines quite vigorous. Clusters medium in size, very compact; berries

small, round, black, with blue bloom, skin thick; pulp half tender, juicy, quality fair; very productive. A grape of very little value here; season last of July.

COLLIER, *Linecumii X Labrusca*—Vines vigorous and strong. Clusters large, compact, shouldered; berries medium to large, round, black, with blue bloom; pulp tender, juicy, pleasant, quality very good; season first of August; fairly productive. One of the best grapes for general use.

DELAGO, *Bourquiniana X Labrusca X vinifera.*—Vines only fairly vigorous. Clusters small, loose; berries medium, round, reddish; pulp tender, juicy, sweet, quality good; season first of August; not very productive. A fair grape for home use.

DELAWBA, *Labrusca X*—Vines small, lacking in vigor. Clusters medium in size, compact; berries medium, round, red, skin thick; pulp tender, juicy, sweet, very pleasant, quality very good; season middle of August; productive. This grape resembles the Delaware very much only later. It is an excellent grape for both home use or market.

DELAWARE, *Bourquiniana or Bourquinana X Labusca.*—Vines fairly vigorous, with slender short-jointed wood. Clusters medium to large in size, well shouldered, very compact; berries medium, round, red, skin thin; pulp tender; juicy, rich, sweet, very pleasant, quality extra good; very productive; season last of July. It is one of the most valuable grapes for both home use, and commercial planting.

DELICIOUS., *Linecumii X Bourquiniana*—Vines quite vigorous. Clusters medium in size, moderately compact; berries medium, round, black, with blue bloom; pulp half tender, quality poor; season middle of August; not productive. A grape of no value here.

DIANA, *Labrusca X vinifera*—Vines vigorous,

Clusters medium in size, compact; berries medium, round, pale red, skin thick; pulp tender, juicy, sweet, pleasant, quality very good; season middle of August; productive. A very good grape for home use, but one and market.

DUCHESS, *Labrusca X vinifera*—Vines fairly vigorous. Clusters small, compact; berries very small, round, greenish white, skin thick; pulp solid, quality very poor; season last of August; productive. A very poor grape here.

EARLY VICTOR, *Labrusca.*—Vines small, lacking in vigor. Clusters small, moderately compact; berries small, round, black; pulp tender, juicy; slightly acid, quality poor; season last of July; not productive. A grape of very little value here.

EATON, *Labrusca*—Vines strong, vigorous. Clusters large, long, shouldered, quite compact; berries very large, round, black, with blue bloom; pulp half tender, juicy, quality fair; season last of July; very productive. A promising grape for market.

ELVICAND, *Labrusca X candicans.*—Vines vigorous. Clusters small, compact; berries medium in size, round, dark red, skin thick; pulp tender, juicy, acid, quality poor; season middle of August; productive. The indications for this grape are not promising.

EMPIRE STATE, *Labrusca X vinifera.*—Vines small, weak. Clusters small, compact; berries small, round, yellowish white; pulp firm; season last of July; not productive. A grape of no value here.

ESTHER.—Vines small, weak, no fruit.

ETTA, *Labrusca X vulpina.*—Vines fairly vigorous. Clusters medium in size, compact; berries small to medium, round, pale yellow, skin thick; pulp tender, juicy, soft, sweet, pleasant; season last of August; fairly productive. A promising grape for home use.

EXCELSIOR, *Labrusca X vinifera.*—Vines vigorous. Clusters medium in size; moderately compact; berries small, round, pale red, skin thin; pulp very tender, juicy, pleasant, quality good; season middle of August; productive. A promising grape for general use.

GENEVA.—Vines small, weak; no fruit.

GOLD COIN, *aestivalis X Labrusca.*—Vines large, vigorous. Clusters large, very compact, broad; berries medium to large, round, yellowish, skin thick; pulp half tender, juicy, sweet, very pleasant, quality extra good; season first of August; very productive. One of the best yellow grapes for both home use or market.

GOETHE, (Rodgers' No. 1), *Labrusca X vinifera.*—Vines quite vigorous. Clusters medium to large, shouldered, moderately compact; berries large, oblong, pale red, skin thin; pulp tender, juicy, sweet, very pleasant, quality extra good; season middle of August; productive. One of the best late grapes for both table use or market.

GREEN MOUNTAIN, (Winchell), *Labrusca X vinifera.*—Vines vigorous. Clusters small, shouldered, very compact; berries small, round, greenish white, skin thin; pulp tender, juicy, sweet; season middle of July; very productive. It is an excellent early grape for home use, but skin is too thin to be of any value as a market sort.

T. B. HAYES, *Labrusca*—Vines small, weak. Clusters medium in size, loose; berries small, white, skin thin; pulp tender, juicy, quality poor; not productive; season last of July. A grape of no value here.

HERBEMONT, (Warren), (Neal), *Bourquinniana*—Vines strong, vigorous; clusters medium in size, compact; berries medium, round, dark red, with blue bloom, skin thin; pulp tender, juicy, sweet, soft, very pleasant;

season last of August; productive. A promising garden grape.

HERBERT, (Rodgers' No. 41.) *Labrusca X Vinifera* Vines quite vigorous. Clusters large, moderately compact; berries very large, round, black, with blue bloom; pulp tender, juicy, pleasant, quality medium; season last of July; productive. A good grape for commercial growing.

HERMAN JAEGER, *Lincecumii X Bourquiniana.* Vines large, strong and vigorous; clusters very large, long, compact; berries small, round, black, with blue bloom, skin thick, pulp firm, seeds free easily, season first of August; very productive. A grape of very little value other than for wine.

HIGHLANDS, *Labrusca X vinifera.*—Vines small, but fairly strong. Clusters medium in size, moderately compact, unevenly ripened; berries large, round, very dark red, with blue bloom, skin tough; pulp tender, juicy, soft, slightly acid, pleasant; season last of August; fairly productive. A fair grape for home use.

HOPKINS, *Lincecumii X aestivalis.*—Vines large and vigorous. Clusters very large, long, compact; berries small, round, black, with blue bloom; pulp firm, acid; productive. A grape of no value other than for wine.

IONA, *Labrusca X vinifera.*—Vines small, weak. Clusters small, moderately compact; berries small round, pale red; pulp tender, juicy, quality poor; season middle of August; not productive. A grape of no value here.

IONA, *Labrusca X vinifera.*—Vines small, weak. ters large, shouldered, compact; berries medium, round, black, with blue bloom; pulp firm, quality medium; season last of July; very productive. A fair market grape if left hanging on the vines until fully ripe.

ISABELLA, *Labrusca.*—Vines small, lacking in

vigor. Clusters medium in size, compact; berries medium, slightly oval, black, skin thick; pulp tender, juicy, quality fair; season first of August, productive. It is not a promising grape here.

JACQUEZ, *Bourquiniana.*—Vines very vigorous and strong. Clusters large, long, compact; berries very small, round, black, with heavy blue bloom; pulp tender, juicy, slightly acid; season middle of August; very productive. Its chief value is for wine.

JEFFERSON, *Labrusca X vinifera.*—Vines vigorous. Clusters medium in size, shouldered, moderately compact; berries medium, roundish oval, pale red, skin thick; pulp tender, juicy, sweet, very pleasant, quality extra good; season middle of August; productive. A very promising grape for general use.

JEWELL.—Vines small, fairly vigorous. Clusters small, moderately compact; berries small, round, black, with blue bloom; pulp tender, juicy, pleasant; season last of August; not productive. A grape of very little value here.

DR. KEMP, *Lincecumii X Bourquiniana*—Vines very strong and vigorous. Clusters large, long, moderately compact; berries medium, round, black, with blue bloom, skin thick; pulp firm, acid, quality fair; season middle of August; very productive. A grape of very little value other than for wine.

LADY WASHINGTON, *Labrusca X vinifera.*—Vines small, lacking in vigor. Clusters medium in size, compact; berries medium, round, pale yellow; pulp tender, juicy, quality poor; season first of August; fairly productive. A grape of very little value here.

LAUSSEL, *Lincecumii X Labrusca æstivalis.*—Vines vigorous. Clusters medium in size, moderately compact; berries medium, round, very hark red, skin thick; pulp

firm, quality poor; season last of August; fairly productive. A grape of no value for general planting.

LINDLEY, (Rodgers' No. 9), *Labrusca X vinifera.* Vines quite vigorous. Clusters large, long, compact; berries medium to large, nearly round, brick red; pulp tender, juicy, sweet, quality very good; season first of August; productive; a promising grape for both home use or market.

LONG JOHN.—Vines very large and vigorous. Clusters large, long, loose; berries large, round, black, with blue bloom; pulp tender, juicy, quality poor; productive; season first of August. A fair market grape.

MARGUERITE, *Lincecumii X Bourquinana.*—Vines strong growers. Clusters medium in size, very compact, broad; berries medium, round, reddish, with a thin blue bloom, skin thin; pulp tender, juicy, soft, slightly acid, quality fair; season last of August; very productive. A promising late grape for general use.

MERIMACK, (Rodgers' No. 19), *Labrusca X Vinifera.*—Vines very small, weak, no fruit. A grape of no value.

MARTHA, *Labrusca.* —Vines small but thrifty. Clusters small, shouldered, compact; berries small, round, pale yellow, skin thin; pulp tender, juicy, sweet, very pleasant, quality very good; season first of August; fairly productive. It is an excellent grape for home use.

MASSASOIT, (Rodgers' No. 3), *Labrusca X vinifera.*—Vines small, lacking in vigor. Clusters small, shouldered, moderately compact; berries medium, roundish, light red; pulp tender, juicy, pleasant, quality good; season last of July; not very productive. A fine grape where it does well, but of little value here.

McPIKE, *Labrusca.*—Vines quite vigorous. Clusters large, compact; berries medium to lage, round, black, with blue bloom, skin thick; pulp tender, juicy, pleasant,

quality very good; season first of August; very productive. A grape resembling the Worden in flavor and color, and a very promising late variety for both home use or market.

MILLS.—Vines all died.

MOORES DIAMOND, *Labrusca X vinifera.*—Vines strong and vigorous. Clusters medium in size, well shouldered, very compact; berries medium, round, white, skin thick; pulp tender, juicy, quality fair; very productive; season middle of July. A very fair white grape for both home use or market.

MOORES EARLY, *Labrusca.*—Vines small, lacking in vigor. Clusters small to medium, shouldered, compact; berries medium, round, black with thin blue bloom; pulp tender, juicy, pleasant, quality fair; season middle of July; not very productive. The indications for this grape are not very promising.

MO. RIESLING, *Labrusca X vulpina.*—Vines fairly vigorous. Clusters medium in size; compact; berries medium, round, white, skin thin; pulp tender, juicy, soft, pleasant, quality good; season last of August; productive. A fair grape for both home use or market.

MONARCH.—Vines vigorous and a strong grower. Clusters large, compact; berries large, round, black with blue bloom, skin thick; pulp half tender, pleasant, quality good; season last of August; productive. A promising market grape.

MONTIFIORE, *Labrusca X vulpina.*—Vines vigorous. Clusters very small, loose; berries small, round, black with blue bloom; pulp firm, quality poor; season last of July; not productive. A grape of no value here.

MOYER, *Labrusca X* ———.Vines small, weak. Clusters small, loose; berries small round, reddish; pulp tender, juicy, soft, quality poor; not productive; season last of July. A grape of very little value here.

R. W. MUNSON, *Lincecumii X Labrusca X vinifera.* Vines large, and a strong grower. Clusters medium to large, fairly compact; berries large, round, black, with blue bloom, skin thick; pulp tender, juicy, quality good; season first of August; fairly productive. A grape promising to become a fair market sort.

MRS. MUNSON, *Lincecumii X Bourquiniana.*—Vines strong and vigorous. Clusters large, long, fairly compact; berries large, round, black, with blue bloom; pulp tender, juicy, quality good; season first of August; fairly productive. This variety resembles the R. W. Munson very much and it is doubtful if any marked distinction can be made between them.

FERN MUNSON, *Lincecumii X Labrusca.*—Vines strong and vigorous. Clusters large, long, compact; berries large, round, very dark red, with blue bloom, skin thick; pulp tender, juicy, slightly acid, quality good; season last of August; very productive. A very promising late grape for general use.

NAHAB.—Vines lacking in vigor. Clusters medium in size, compact; berries medium, round, white, skin thin, pulp tender, juicy, slightly acid; season middle of August; not productive. A grape of little value here.

NIAGARA, *Labrusca.*—Vines vigorous and a strong grower. Clusters large, very compact, well shouldered; berries large, round, greenish, or yellowish white, skin rather tough; pulp tender, juicy, rich, musky, very pleasant, quality extra good; season last of July; very productive. A very promising grape here. The Niagara is one of the best, if not the best white grape for both home use or commercial growing.

NORFOLK, *Labrusca.*—Vines vigorous. Clusters

large, compact; berries very large, round, dark red; pulp tender, juicy, pleasant, quality good; season last of July; productive. A fair market grape.

NORTON, *æstivalis*.—Vines very vigorous. Clusters large, long, shouldered, compact; berries very small, round, black, with blue bloom; pulp half tender, slightly acid, quality fair; season middle of August; very productive. Its chief value is for wine.

OZARK.—Vines small, weak, no fruit.

PALLIAT.—Vines vigorous and a strong grower. Clusters large, long, shouldered, compact; berries small, round, black, with blue bloom, skin thin; pulp tender, juicy, soft, slightly acid; season last of August; fairly productive. Its chief value is for wine.

PERKINS, *Labrusca*.—Vines very strong and vigorous. Clusters large, long, shouldered, compact; berries large, round, yellow, skin thick; pulp tender, juicy, sweet, pleasant, quality good; season last of July; very productive. A very good grape for home use, but one which shells too much for market purposes.

PRENTIS, *Labrusca X vinifera*.—Vines very small, and weak. A grape of no value here.

PRESLEY, *Labrusca X vulpina*.—Vines only fairly vigorous. Clusters small, moderately compact; berries very small, round, dark wine color; pulp tender, juicy, quality poor; season last of July; not productive. A grape of no value here.

ROCKWOOD, *Labrusca*.—Vines slow growers, but fairly vigorous. Clusters large, long, shouldered, compact; berries medium, round, black with thick blue bloom; pulp tender, juicy, pleasant, quality fair; season middle of July; fairly productive. A grape of some

promise for both garden and market planting; ripens with Champion but of much better quality.

ROMMEL, *Labrusca X vulpina X vinifera.*—Vines strong and vigorous. Clusters large, compact; berries medium, round, greenish white, skin thin; pulp tender, juicy, quality fair; season last of July; productive. A fair grape for garden planting.

SALEM, (Rodgers' No. 22), *Labrusca X vinifera.* Vines very vigorous. Clusters large, long, loose; berries large, round, dark dull red, skin thick; pulp tender, juicy, pleasant, quality very good; season first of August; fairly productive. It is one of the best for the home garden.

TRIUMPH, *Labrusca X vinifera.*—Vines strong and healthy. Clusters large, shouldered, long, compact; berries medium, round, white, skin thick; pulp tender, juicy, pleasant, quality good; season middle of August; fairly productive. A very promising grape for general planting.

ULSTERS PROLIFIC, *Labrusca X* ——.Vines very small, weak. A grape of no value.

VERGENNES, *Labrusca.*—Vines very small, weak.

WILDER, (Rodgers' No. 4), *Labrusca X vinifera.* Vines vigorous and strong. Clusters large, long, shouldered, moderately compact; berries large, round, black, with thin blue bloom; pulp tender, juicy, soft, pleasant; quality very good; season first of August; productive. A valuable grape for home use.

WORDEN, *Labrusca.*—Vines only fairly vigorous. Clusters large, long, moderately compact; berries large, round, black, with heavy blue bloom, skin thin; pulp ten-

der, juicy, rich, pleasant, quality very good; season first of August; productive. One of the best for home use, but does not ripen even enough to make a good grape for market growing.

WYOMING, *Labrusca X vinifera.*—Vines small, slender, fairly vigorous. Clusters medium in size; compact; berries medium, round, dark wine color; pulp tender, juicy, sweet, quality good; season last of July; fairly productive. A fair grape for home use.

SCUPPERNONGS (*Vitis rotundifolia*.

MEMORY.—Vines large, strong, vigorous; berries large, round, dark brown, with white specks over the surface, skin very thick; pulp tender, juicy, soft, pleasant; season later part of August; very productive. This is the earliest variety here, and a very fine one for eating out of hand.

SEEDLING.—Vines rather small and not very vigorous. Berries very large, smooth, nearly round, very dark red; pulp tender, juicy, pleasant, slightly acid; productive; season first of September.

JETER.—Vines strong and vigorous. Berries large, round, dark brown, skin very thick; pulp tender, juicy, soft, pleasant; season later part of July; very productive.

THOMAS.—Vines somewhat lacking in vigor. Berries medium in size, very dark red, smooth, slightly oblong, skin medium; pulp very tender and juicy, nearly sweet, rich; very productive; season last of July. It is a choice fruit for home growing.

FLOWERS.—Vines very strong and vigorous, berries medium, round, smooth, shinny black, skin leathery;

pulp firm, acid, quality poor; very productive, and hangs on the vine a long while; season middle of September.

MISH.—Vines large and strong growers. Berries small, nearly round, smooth, black with very small brown specks over the surface, skin medium; pulp tender, juicy, soft, very sweet; exceedingly productive; season early September. This is the only variety we have which has a distinct sweet taste. It is very fine for eating out of hand.

TENDERPULP.—Vines very large and vigorous. Berries medium, round, smooth, black, skin leathery; pulp tender, very juicy and soft, seeds free easily, quality very poor; very productive; season middle of September. A variety of very little value.

Of the above kinds the following list seems worthy of farther trial for market and general purposes while the second list are of especially fine quality for home use.

VARIETIES WORTHY OF FARTHER TRIAL FOR MARKET.

America, Delawba, Herbert, Monarch, Beacon, Diana, Jefferson, R. W. Munson, Big Hope, Eaton, Lindley, Fern Munson, Carmen, Excelsior, Long John, Norfolk, Centennial, Gold Coin, McPike, Rockwood, Collier, Goethe, Mo. Riesling, Triumph.

VARIETIES OF VALUE FOR HOME USE.

Agawam, Etta, Highland, Rommel, Brilliant, Green Mountain, Martha, Salem, Delago, Herbemont, Riqua, Wilder, Wyoming.